BELKNAP STREET VIADUCT
(Belknap Street Overpass)
Texas Historic Bridges Recording Project
Spanning BNSF, SP, and UP Railroads
at Belknap Street (U.S. Route 377)
Fort Worth
Tarrant County
Texas

HAER No. TX-49

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
U.S. Department of the Interior
National Park Service
1849 C Street NW NC300
Washington, DC 20240

HISTORIC AMERICAN ENGINEERING RECORD

BELKNAP STREET VIADUCT
(Belknap Street Overpass)

HAER No. TX-49

Location:	Spanning Burlington Northern Santa Fe (BNSF), Southern Pacific (SP), and Union Pacific (UP) railroads at Belknap Street (U.S. Route 377), Fort Worth, Tarrant County, Texas. UTM: 14/656730/3625750 USGS: Haltom City, Texas, quadrangle.
Date of Construction:	1933.
Designer:	Francis Dey Hughes, consulting engineer, Dallas, Texas.
Builder:	Butcher and Sweeny; Virginia Bridge and Iron Works, Roanoke, Virginia, steel fabricator.
Present Owner:	City of Fort Worth.
Present Use:	Vehicular bridge.
Significance:	This example of an early 1930s concrete viaduct serves a major gateway to Fort Worth and is an important work of Dallas bridge designer F. D. Hughes.
Historian:	Robert W. Jackson, August 1996.
Project Information:	This document was prepared as part of the Texas Historic Bridges Recording Project performed during the summer of 1996 by the Historic American Engineering Record (HAER). The project was sponsored by the Texas Department of Transportation (TxDOT).

Introduction

The Belknap Street Viaduct is one of several viaducts in the Dallas-Fort Worth area representing the work of bridge engineer F. D. Hughes. Hughes was a designer of extensive experience whose career reached its zenith in the Depression-era concrete and steel viaducts of the Dallas-Fort Worth metroplex. It was built as a joint venture by Tarrant County and the City of Fort Worth as part of a plan to improve State Route 10, also known as the Keller Cardinal Highway and now identified as U.S. Route 377. It consists of a series of arched fascia concrete girder spans and variable-depth steel girders with concrete slab approaches, and has a total length of approximately 1,274 feet.[1]

Description

The bridge, completed in 1933, is modernistic in design and features ornamental concrete details, such as the initials "TC" and "FW" formed into some of the railing posts. The original Westinghouse light standards, since removed, were also highly ornamental. Particularly of note is the use of four Westinghouse Commerce Newel Style No. 353251, five-globe standards with eagle ornamentation placed at the east and west portals of the bridge.

Motorists passing over the roadway of the bridge can little appreciate the complex design of the structure, which is apparent from underneath. Hughes had to account not only for the necessity of spanning the existing main and spur tracks of the Saint Louis and Southwestern Railroad, the Fort Worth and Denver Railroad, and the Texas and Pacific Railroad, he also had to account for the existing and proposed tracks of the Chicago, Rock Island, and Gulf Railroad (CRI&G). A freight depot is located immediately south of the bridge, and switching facilities are located immediately to the north. In addition, several local streets run underneath the bridge, although there is no indication that these streets were a design constraint when the bridge was built.

Beginning at the west, the bridge is composed of a three-section abutment 133'-3" long with a segmented retaining wall; a two-span approach group 60'-0" long; a 16'-0" tower pier; a three-span steel girder group over the Saint Louis and Southwestern, Fort Worth and Denver, and Texas and Pacific railroad tracks with an overall length of 162'-0"; another 16'-0" tower pier; a 231'-8" five-span concrete group; another 16'-0" tower pier; a 185'-8" four-span concrete group; a 205'-4" four-span steel group over the CRI&G tracks with two 16'-0" tower spans at each end and three four-column bents between; another 231'-8" five-span concrete group; and a 16'-6" eastern abutment. Basically, Hughes utilized as many concrete girders of a uniform length

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[1] Most of the information in this report concerning dimensions and specifications for the bridge is taken from Tarrant County Highway Department, "Plans For Proposed Viaduct on Belknap Street, Co. Project No. 358J" (Texas Department of Transportation, Environmental Affairs Division, Austin, Texas).

(46'-0") as possible — fourteen in all — for those portions of the bridge not crossing the railroad tracks, except for the western approach where a 30'-0" and a 38'-0" concrete girder were used. The portions crossing the tracks were constructed with variable-depth, haunched steel girders, thus allowing for greater vertical clearance than could be achieved with concrete girders.

The steel girder group over the CRI&G tracks is particularly complex because the tracks cross the axis of the bridge at an acute angle and are irregularly spaced, thus requiring the four-column bents to be spaced irregularly and placed at an acute angle to the axis of the bridge. Whereas the steel girder between the first bent (westernmost, identified as Column C3 on the plans) and second bent (Column C4) is only 34'-0" long, the steel girder between bents two and three (Column C5) is 60'-0" long. The bents are composed of two concrete columns connected by steel cross-bracing, grouped in pairs to form one complete bent of four columns.

The steel girder group over the set of tracks west of the CRI&G tracks is less complex because the more regular track placement allowed for a more balanced arrangement of columns. The 65'-0" center span is flanked by a 51'-6" span and a 45'-6" span, and is supported by two, two-column piers (C1 and C2 on the plans) much simpler than the bents supporting the CRI&G group.

All of the steel girders of this bridge were manufactured by Virginia Bridge and Iron Works of Roanoke, Virginia, and encased in concrete on site to provide an overall continuity in the appearance of the structure. Hughes was following the precedent of the four concrete and steel viaducts he designed in 1929 to span the Trinity River in Dallas. Together with the Belknap Street Viaduct, these bridges survive as the best known work of a prolific but largely forgotten bridge designer.

Francis Dey Hughes

Hughes, who preferred to be identified during his professional life as "F. D.," was born in Sibley, Missouri, on September 13, 1872. Three years after graduating from the public school system of Jackson County, Missouri, he found employment as a rodman, levelman, draftsman and chief of surveyor's party in the county engineer's office, Kansas City, Missouri. About 1895 he advanced to the position of office engineer, and continued in that capacity until 1897. From 1897 to 1898 he worked as a draftsman and estimator for the Kansas City Bridge Company, occasionally doing some design work. From 1898 to 1899 he worked as a shop detailer and designer for the Clinton Bridge and Iron Works of Clinton, Iowa, working on bridges, water tanks, and towers. After leaving Clinton, he briefly worked at the Lafayette Bridge Company of Lafayette, Indiana, as a detailer and checker on road and railroad bridge designs before moving on to the Midland Bridge Company of Kansas City, Missouri, in 1901. While at Midland he functioned as an assistant engineer, working on almost every class of bridge and structural work, including road and railroad bridges, water works, and pneumatic foundations. He took courses at Spalding College in Kansas City during his employment at Midland, including a special night

class in mathematics, and he may have also briefly attended Lafayette College (Purdue University) during his stay in Indiana.

From 1903 to 1904 Hughes became chief engineer and plant manager of the small fabricating plant of Southwestern Bridge and Iron Company in Enid, Oklahoma. After the facility went into receivership, Hughes moved to Roanoke, Virginia, where he worked as a special squad foreman and checker in the drafting room for the Virginia Bridge and Iron Company. His stay in Roanoke was even shorter than in Enid, and in 1905 he relocated to Kansas City to work for Illinois Steel Bridge Company, which had its home office at Jacksonville, Illinois.

Hughes spent more than nineteen years at this company, which was his longest period of employment by a single firm. He was contract and construction manager for all territory west of the Mississippi River and south of the Missouri River. After ten years in Kansas City he moved to the Saint Louis office, were he was design engineer for both the Saint Louis and home offices. He designed highway and railway bridges, viaducts, mill buildings, auditoriums, mine frames and tipples, and foundries.

From 1924 to 1926, Hughes was chief engineer, secretary, and manager for Concrete and Steel Construction Company of Joplin, Missouri, a firm that specialized in highway and building construction, and mine structures. He purchased an interest in this company in 1925 but sold it in 1926. From 1926 to 1927 he was contracting and chief engineer for Pioneer Construction Company of Kansas City, Missouri.

It was in 1928 that Hughes and his wife, Callie, moved to Dallas where he began his career as a consulting engineer. Hughes maintained an office in Kansas City until October 1930, even though he also had an office in Dallas from 1928. During his career as a consultant, he worked on the following projects:

National Avenue Subway, Springfield, Missouri
Benton Avenue Viaduct, Springfield, Missouri
Arkansas River Bridge, Sedgwick, Kansas
Trinity River Viaducts (four), Dallas, Texas
Corinth and Cadiz Street Underpasses, Dallas, Texas
Concho River Bridges, San Angelo, Texas
Trinity River Bridges (sixteen), Tarrant County, Texas
Belknap Street Viaduct, Fort Worth, Texas
Triple Underpass, Dallas, Texas
T.A.T. shop and hangar, Love Field, Dallas, Texas

He was also hired as a consulting engineer to check the designs of various projects in Oklahoma and Texas, and in April 1935 accepted a position with the Saint Louis and San Francisco Railway as special designing engineer for grade separation projects in Fort Worth, Arkansas, and Birmingham.

With no formal education in engineering, Hughes was an example of a type of engineer rapidly fading from professional practice in the 1930s. Whereas most of his contemporaries had either an engineering degree or at least some college credits in engineering, Hughes acquired all of his engineering education through actual practice or private study. He learned how to design bridges by working for companies that built bridges, thus benefiting from a tradition of American bridge building and design that was based on practical knowledge derived from empirical observation of what did or didn't work in the field. On the basis of this practical knowledge, Hughes became an associate member of the American Society of Civil Engineers in 1902, a member in 1912, and a life member in 1937. His application for registration as a professional engineer in Texas was approved based on his practical experience, and he was issued certificate No. 2372 in April 1938.[2]

In his design and execution of the Belknap Viaduct, Hughes was assisted by W. D. Kelly, assistant engineer, and Wesley Stevens, Tarrant County engineer. The contract for construction was awarded to Butcher and Sweeny, and the final cost was approximately $350,000.[3]

Although currently in poor condition and slated for replacement, the Belknap Street Viaduct is a good example of Depression-era reinforced concrete bridge construction, and is a valuable part of the transportation infrastructure of the Fort Worth urban area. In addition, it serves as one of the few extant reminders of the work of F. D. Hughes, a little known engineer whose work contributed significantly to the urban landscape of the Dallas-Fort Worth metroplex.

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[2] Most of the information concerning Hughes contained in this report is obtained from his "Application For Registration To Practice Professional Engineering," 1937 (Texas State Board of Registration for Professional Engineers, Austin, Texas). See also "Research Data, Fort Worth and Tarrant County, Texas" (Fort Worth: Texas Writer's Project, Fort Worth Public Library Unit, 1941), pp. 18297, 20684, 20776, 21102; John F. Worley, ed., *Worley's Dallas (Texas) City Directory* (Dallas: John F. Worley Directory Company, 1929), pp. 41, 1101, 1263, and subsequent volumes for 1930-35; *The State of Texas Registered Professional Engineers: July 1939 Roster* (Austin: State Board of Registration For Professional Engineers, 1939), p. 47, and subsequent volumes for 1940-46; *Austin American Statesman,* 3 July 1953; and *Dallas Morning News,* 3 July 1953.

[3] The estimate of cost was provided by Ray Edwards, Department of Transportation Services, Tarrant County (interview by author, 12 July 1996).

SOURCES CONSULTED

Austin American-Statesman, 3 July 1953.

Edwards, Ray, Tarrant County Department of Transportation Services. Interview by author, 12 July 1996.

Dallas Morning News, 3 July 1953.

Hughes, F. D. "Application For Registration To Practice Professional Engineering," 1937. Texas State Board of Registration For Professional Engineers, Austin, Texas.

Research Data, Fort Worth and Tarrant County, Texas. Fort Worth: Texas Writer's Project, Fort Worth Public Library Unit, 1941.

The State of Texas Registered Professional Engineers: July 1939 Roster. Austin: State Board of Registration For Professional Engineers, 1939.

Tarrant County Highway Department. "Plans For Proposed Viaduct On Belknap Street, Co. Project No. 358J." Texas Department of Transportation, Environmental Affairs Division, Austin, Texas.

Worley, John F., ed. *Worley's Dallas (Texas) City Directory.* Dallas: John F. Worley Directory Company, 1929-35.

APPENDIX: Suggestions for Further Research

Due to limitations in the scope of the Texas Historic Bridges Recording Project, several questions which arose during the research and writing of this report remain unanswered. It is suggested that scholars interested in this bridge consider pursuing the following:

1. What was the nature of the joint venture between Tarrant County and the City of Fort Worth, and how much control did the city have over the design of this bridge?

2. What other bridges were built by Butcher and Sweeny?

3. When were the light standards removed, and why?

ADDENDUM TO:
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HAER No. TX-49

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HISTORIC AMERICAN ENGINEERING RECORD

BELKNAP STREET VIADUCT
(BELKNAP STREET OVERPASS)

This report is an addendum to a 6-page report previously transmitted to the Library of Congress in 1996.

Location:	Spanning the Union Pacific, Burlington Northern Santa Fe, and Southern Pacific Railroad tracks at Belknap Street, Fort Worth, Tarrant County, Texas UTM: 14/656730/3625750 USGS Quad: Haltom City, Tex.
Date of Construction:	1934
Designer:	Francis Dey Hughes, consulting engineer, Dallas, Texas
Builder/Contractor:	Butcher & Sweeny, Contractors, Fort Worth, Texas
Fabricator:	Virginia Bridge and Iron Works, Roanoke, Virginia
Present Use:	Roadway bridge, undergoing replacement as of July 2000.
Significance:	This example of an early 1930s era concrete viaduct serves a major gateway to Fort Worth and is an important work of Dallas bridge engineer Francis Dey Hughes.
Historian:	Robert W. Jackson, Ph.D., August 2000.
Project Information:	This document was prepared as a part of the Texas Historic Bridges Recording Project II performed during the summer of 2000 by the Historic American Engineering Record (HAER). The project was sponsored by the Texas Department of Transportation (TxDOT), Environmental Affairs Division.

INTRODUCTION

The Belknap Street Viaduct was one of several bridges built in the Dallas-Fort Worth area representing the work of bridge engineer Francis Dey Hughes. Hughes was a designer of extensive experience whose career reached its zenith in the Depression-era concrete and steel viaducts of the Dallas-Fort Worth metroplex. Tarrant County and the City of Fort Worth built the Belknap Street Viaduct as part of a plan to improve an approximately two mile long section of S. H. 10 (now identified as U.S. 377) between Fort Worth and the intersection of S. H. 10 and S. H. 121, just west of the small community of Birdville. This highway was an extension of East Belknap Street in Fort Worth and connected the central business district with the suburb of Riverside, and with the small Tarrant County communities of Keller (on S. H. 10) and Grapevine (on S. H. 121). The viaduct was built approximately one year after the Trinity River Bridge, located east of the Belknap Street Viaduct on S. H. 10.[1]

IMPROVEMENT OF STATE HIGHWAY 10

Improvement of S. H. 10 was just one part of a general five-year program begun by the Fort Worth Chamber of Commerce in 1928 that was designed to promote trade, lure new industries, and upgrade the city's transportation infrastructure. The ten major goals of the effort included completion of the county road building program recommended by the Chamber's Highway Committee (goal IV), and elimination of all grade crossings in the city through construction of underpasses and overpasses (part of goal VIII). Following approval of the program by the Tarrant County Commissioner Court, a general obligation road and bridge bond election was held that resulted in a victory for the Chamber of Commerce.[2] It was several years, however, before some of the projects envisioned as part of the program were actually begun.

The Belknap Street Viaduct, completed in 1934, was in the process of replacement as of this writing. As originally constructed, it consisted of a series of arched fascia concrete girder spans and variable depth steel girders with concrete slab approaches, and had a total length of approximately 1,274'.[3] It was modernistic in design and featured ornamental concrete details, such as the initials "TC" and "FW" formed into some of the railing posts. The original Westinghouse light standards, previously removed, were also highly ornamental. Particularly of

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[1] Historic American Engineering record (HAER), National Park Service, U.S. Department of the Interior, "East Belknap Street Bridge," HAER No. TX-88.

[2] Fort Worth Chamber of Commerce, *Five Years of Progress, Fort Worth, 1928-1932,* 31 December 1932 (50 Anniversary Commemorative Re-Issue, Fort Worth: Graphic History Limited, 1982.)

[3] Most of the information in this report concerning dimensions and specifications for the bridge is taken from Tarrant County Highway Department, "Plans For Proposed Viaduct on Belknap Street, Co. Project No. 358J," in the files of the Texas Department of Transportation, Environmental Affairs Division, Austin, Tex.

note is the use of four Westinghouse Commerce Newel Style No. 353251, five globe standards with eagle ornamentation placed at east and west portals of the bridge.

Bridges identified as having been designed by Hughes that were built in the Fort Worth area (in addition to the Belknap Street Bridge) include the Stove Foundry Road (West Vickery Boulevard) Bridge over the Clear Fork of the Trinity River (1930), the East First Street Bridge over the West Fork of the Trinity River (1936), the Purvis Road (Burleson Street, NW Twelfth Street, or North University) Bridge over the West Fork of the Trinity River (1938), and the Frey Avenue Bridge over the West Fork of the Trinity River (1946).

With no formal education in engineering , Hughes was an example of the type of engineer rapidly fading from professional practice in the 1930's. Whereas most of his contemporaries had either an engineering degree or at least some college credits in engineering, Hughes acquired all of his engineering education through actual practice or private study. He learned how to design bridges by working for companies that built bridges, thus benefitting from a tradition of American bridge building and design that was based on practical knowledge derived from empirical observation of what worked or didn't work in the field. On the basis of his practical knowledge, Hughes became an associate member of the American Society of Civil Engineers in 1902, a member in 1912, and a life member in 1937. His application for registration as a professional engineer in Texas was approved based on his practical experience, and he was issued certificate number 2372 in April 1938.[4] Hughes was sixty-five years old when registered, and nearing the end of his professional career. In 1939, he transferred his registration to Amarillo, Texas, and in 1940 he again transferred his registration, this time to Austin, Texas, the home of his son, Frank Miller Hughes.[5] Although he was associated with the Dallas engineering firm of Koch and Fowler at the time of his official retirement in 1952, it appears that he worked on few large projects after 1938. He died in 1953 and is buried in Austin, Texas.

In his design and execution of the Belknap Street Viaduct, Hughes was assisted by W. L. Kelly, who later became county engineer of Tarrant County in 1935. A native of the state, born in Comanche, Texas, in 1894, Kelly had worked in architectural engineering for the five years prior to joining the county engineer's office as an assistant engineer in 1931. He was promoted

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[4] Most of the information concerning Hughes contained in this report is obtained from his 1937 "Application For Registration To Practice Professional Engineering," on file at the Texas State Board of Registration for Professional Engineers, Austin, Texas. See also "Research Data, Fort Worth and Tarrant County, Texas" (Fort Worth: Texas Writer's Project, Fort Worth Public Library Unit, 1941), 18297, 20684, 20776, 21102; John F. Worley, ed., *Worley's Dallas (Texas) City Directory* (Dallas: John F. Worley Directory Co., 1929), 41, 1101, 1263, and subsequent volumes for 1930-35; *The State of Texas Registered Professional Engineers: July 1939 Roster* (Austin: State Board of Registration For Professional Engineers, 1939), 47, and subsequent volumes for 1940-46; *Austin American Statesman*, 3 July 1953; *Dallas Morning News*, 3 July 1953.

[5] Frank Miller Hughes inherited his father's love of engineering, and worked many years as a bridge engineer for the Texas Highway Department.

to bridge engineer in July 1933, and was in full charge of the Belknap Street Viaduct project during the last fourteen months of the construction phase. Some of his remaining works as county engineer include the University Drive Bridge (southbound) over the Clear Fork of the Trinity River (1936), and the Old Denton Road Bridge over Henrietta Creek (1939).

To celebrate completion of the nearby Trinity River Bridge and ground breaking for the viaduct, approximately 12,000 citizens of Fort Worth and nearby communities assembled on Sunday 13 March 1933, for a parade nearly three miles long. One of the largest in the history of underpass and overpass celebrations in Fort Worth, the parade began downtown and ended at a point between the Trinity River bridge and the east end of the proposed viaduct. Participating in the parade were about 300 automobiles, long columns of khaki-clad Reserve Officer Training Corps (R.O.T.C.) units, the Fort Worth Police Band, the R.O.T.C. band, the Texas Woman's College pep squad, the Texas Christian University band and sweetheart, an ancient touring car overflowing with "Riverside Sunshine Girls" in snappy new uniforms, a truck full of Fort Worth Recreation Department singers in fluffy organdy uniforms, myriad other celebrants.[6]
From a temporary platform built on the edge of the river bridge, J. J. Hurley, former president of the Riverside Civic League and long-time advocate of the bridge and viaduct, delivered the main dedication speech. "We are grateful to the city council," he told the assembled multitude, "grateful to the railroads, grateful to the county commissioners, grateful to everybody."[7]
Following the orations of Hurley and various other government officials, approximately twenty vaudeville performers entertained on the bridge until a huge bonfire was lighted near dark west of the structure. Revelers danced around the fire until it died to embers, and then reassembled on the bridge where fiddle players provided music for square dancing until late in the evening.
The contract for construction of the Belknap Street Viaduct was awarded to Butcher & Sweeny, general contractors based in Fort Worth. This firm built a number of bridges in Tarrant County during the 1930s, and was quite successful in competition with other companies. The final cost of the bridge, most of which represented fees paid to the contractor, was approximately $350,000.[8]

On Thursday, 12 April 1934, the viaduct was formally dedicated, even though Butcher & Sweeny had yet to build shoulders at the east end. It was only open to the public before 8:00 a.m. and after 5:00 p.m. to accommodate rush hour traffic. Nonetheless, a parade consisting of approximately eighty-five floats and automobiles passed down the highly decorated East Belknap Street to a point between the viaduct and river bridge. The line of march was led by young ladies designated as "Miss Civic Achievement" and "Miss Progress," who were preceded by trumpeters on horseback, and included six bands, 800 high school cadets, and members of the

[6] *Fort Worth Star-Telegram*, 25 and 26 March 1933.

[7] *Fort Worth Star-Telegram*, 26 March 1933.

[8] Ray Edwards, Department of Transportation Services, Tarrant County provided the estimate of cost. Interview by author, 12 July 1996.

"El Ranchito Polo Club." At dark the two bridges were lighted for the first time, and a large fireworks display was followed by square dancing.[9]

The Belknap Street Viaduct was a good example of Depression-era reinforced concrete bridge construction, and was a valuable part of the transportation infrastructure for the Fort Worth urban area. In addition, the Belknap Street Viaduct served as Fort Worth's finest example of the work of F. D. Hughes, a bridge engineer whose designs contributed significantly to the urban landscape of the Dallas-Fort Worth metroplex.

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[9] *Fort Worth Star-Telegram*, 8, 9, 10, 11, 13 March 1934.

SOURCES CONSULTED

Austin American-Statesman. 3 July 1953.

Edwards, Ray, *Tarrant County Department of Transportation Services.* Interview by author, 12 July 1996.

Dallas Morning News. 3 July 1953.

Fort Worth Star-Telegram. 25 and 26 March 1933; 8, 9, 10, 11, 13

Hughes, F. D. "Application For Registration To Practice Professional Engineering," 1937. On file at Texas State Board of Registration For Professional Engineers, Austin, Tex.

Research Data, Fort Worth and Tarrant County, Texas. Fort Worth; Texas Writer's Project, Fort Worth Public Library Unit, 1941.

The State of Texas Registered Professional Engineers: July 1939 Roster. Austin: State Board of Registration For Professional Engineers, 1939.

Tarrant County Highway Department. "Plans for Proposed Viaduct on Belknap Street, Co. Projects No. 358J." In the files of the Texas Department of Transportation, Environmental Affairs Division, Austin, Tex.

Worley, John F. Ed. *Worley's Dallas (Texas) City Directory.* Dallas: John F. Worley Directory Co., 1929-35.

Fort Worth Star-Telegram. 25 and 26 March 1933; 8, 9, 10, 11, 13 March 1934.